

From TFS to KALT: Evolution of Military Learning

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POWERFUL INFORMATION technologies are dramatically improving today's Army. In virtually every sphere, technologies unheard of a few years ago now promise to revolutionize diverse operations. One area that information technology systems have already significantly affected is training. More than ever before, information technology systems are forging and refining soldiers' battlefield skills, changing the face of Army training. From new software at the heart of the Standard Army Training System (SATS) to complex instrumentation systems at the combat training centers, new information technologies are producing soldiers with skills to dominate operations across the spectrum of conflict. High-tech training devices and simulations are here to stay. The information technologies that they embody determine how and where the Army trains, dramatically improve the commander's ability to plan and manage training, and provide leverage that improves training effectiveness.

As with all revolutions, maximizing information technology's benefits depends on the initiative and determination of the user—applications developed in a laboratory are not necessarily as effective as those developed in the field. This article shares the story of how one small technology-related training improvement was developed and applied in the field, how it might have been applied to today's institutional training pillar and how it might be changed to meet the Army's future needs. It started at the Combat Maneuver Training Center (CMTC), Hohenfels, Germany, where trainers searched for ways to better manage unit training and the training feedback process.

Origins of the Training Feedback System

During an autumn 1994 rotation at the CMTC, the Army Research Institute (ARI) demonstrated an electronic clipboard system (ECS) for collecting performance data on units undergoing training and providing better feedback to commanders. The new system was complex, cumbersome to assemble and, once booted, forced users to crawl through bewil-

Learners will need to build knowledge proactively. Heimstra believes more research is needed to determine better ways of incorporating computer technology and electronic communication into self-directed learning as more distance education programs are created.

dering, information-laden screens. The ECS was a good idea but was not much help and ended up stowed in a wall locker. What the CMTC team really needed was a simple, user-friendly program to liberate the center's overworked observer/controllers (O/Cs) from the cumbersome, manual methods of recording observations on note cards and the time-consuming drill required to translate these observations into feedback for commanders.

O/C Feedback. O/Cs' primary mission is to provide useful feedback to individuals and units training at the center. Feedback is provided in two forms: after-action reviews (AAR) and mission or battle summaries. In the field, an AAR can take various forms—from an informal backbrief on butcher-paper charts to scaled replications of the unit and battle, such as a sand table. Once the unit has completed the training, a formal, fully instrumented AAR in the center's training analysis facility (TAF) is typically conducted. This AAR makes full use of the TAF's simulation technologies, voice- and data-capturing capabilities and high-resolution graphics.

The mission or battle summary takes one to two pages for each battle. Done correctly, a mission or battle summary identifies and articulates deficiencies within each of the battlefield operating systems (BOS) by phase (planning, preparation or execution) for each mission. These summaries are key parts of the unit's take-home package that commanders and operations officers use to assess mission-essential task list (METL) training deficiencies, overall unit readiness and create a training plan that will address

shortfalls. Ideally, the unit receives its take-home package before departing the training center.

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process. Furthermore, the higher the echelon, the more time is required to document the results. Battalion- and brigade-level training place the heaviest burdens on the overworked O/Cs.

Before automation, the senior task force O/C had about seven hours from the change-of-mission time, when a battle is officially considered terminated, to organize a formal AAR, which usually required two hours to present. To collate, input and edit data in a word processor for the written battle summary took another three or four hours. That made 12 to 13 hours for feedback preparation and delivery, a heavy burden when one considers that during a unit rotation, as many as five battles might be fought in a seven-day period. A better-designed system could have cut hours from this drill.

The training feedback system (TFS) debut. While the ECS did not meet the needs of the O/Cs, it did catalyze the creation of an electronic feedback tool. Inspired by the concept, CMTC personnel initially worked with ARI to reprogram the ECS's database. While ARI provided everything the O/C team requested, the reprogramming chore proved to be a greater challenge than the team could meet. Convinced that the device had utility, a group of the team's officers and noncommissioned officers (NCOs) analyzed their technical and operational needs. They concluded that the concept was worth pursuing—but not by simply tweaking the ECS. A whole new capability was required, which the team dubbed the training feedback system.

Trainers decided to adopt Microsoft Office, an off-the-shelf integrated software package that met their needs and could operate on any available computer. One of the team's NCOs took the program-

ming challenge, guided by feedback and recommended changes from the O/Cs, who best knew what would fulfill their needs. Microsoft Office proved to be the ideal program for creating the TFS.

The original purpose of the TFS was to reduce the time required to produce mission summaries. A good place to start was to replace the note cards each company/team and O/C gave the senior trainer for AAR and battle summary production. Immediately collected following a battle, each O/C would brief the senior trainer at a field site on notes collected and critical tasks observed during the course of the battle. It was not uncommon for senior trainers to depart the field on their way to the AAR with more than 120 cards. Sorting and assimilating data for the battle summary consumed three to four hours following the AAR.

Another issue to improve was the quality of input from subordinate O/Cs. Most of the O/Cs, while extremely competent, had disparate frames of reference on how to execute doctrine, which led to considerably different opinions on what was considered relevant to success. Digitizing the appropriate mission training plans (MTPs), with their associated tasks, conditions and standards and their training and evaluation outlines, was the immediate response for standardizing input and feedback. MTPs, however, do not lend themselves to training center combined arms missions because written MTP tasks are independent, but actual CTC activities are highly intertwined.¹

This was one area where the ECS could help, for it incorporated a task-analysis technique that was suitable to the training center environment. Based on work ARI, Presidio of Monterey (ARI-POM), a set of mission-based critical task lists had been created that mirrored the training feedback process already in use at the National Training Center (NTC), Fort Irwin, California.² The ECS had embedded a task list for each of the major missions (attack, defend and movement to contact) and for each echelon (platoon, company/team and battalion/task force). The tasks from each of the lists were developed and depicted in a battle-flow framework, beginning with those tasks associated with planning, then moving through the tasks associated with preparation and finally culminating with the tasks associated with execution. Tasks were not only sequenced but also linked to other tasks to demonstrate the interactive nature of tasks as they progressed. Finally, the task lists integrated the critical tasks associated with all BOS in a common framework, thus providing a truly combined arms approach to monitoring task accomplishment at any of the three echelons.

The CMTC team felt that the ECS task lists provided a logical approach to data collection. Adapt-



Digitized training management makes electronic versions of manuals, MTPs and SOPs available during field training. Those products link to the orders and assessments generated elsewhere—whether a FRAGO and an AAR in a field TOC or the highly instrumented process in the “Star Wars” building.



US Army

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ing them to the new TFS system promised both to simplify the feedback process and standardize the collection and feedback process. Analysis of the battalion/task force task lists by the O/C team members revealed a number of interesting points. Task lists had been intricately linked to appropriate MTPs, but each task list proved more detailed and complete than the MTPs. Critical tasks and respective standards not found in the MTPs had been derived from the appropriate doctrinal manuals. Many of the battalion/task force tasks were derived from the dated primary doctrine, US Army Field Manual 71-2, *The Tank and Mechanized Infantry Battalion Task Force*.³ They also correlated well with the newer tactics and techniques manual, US Army Field Manual 71-123, *Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion Task Force and Company Team*.⁴ Most important, the ECS-developed task lists were comprehensive. They even included most of the tasks that the battalion-level O/Cs already focused on during a mission, the same tasks that were normally discussed with the senior trainer at the post change-of-mission debrief. Building an O/C-friendly data-collection and feedback tool based on these ECS task lists now had the potential of streamlining the data-collection requirement by eliminating the debrief session, as well as simplifying and standardizing the remainder of the feedback process.

The first edition of the TFS had modest objectives: focusing on collecting the data into a database, then transferring it to word processing to facilitate editing and capturing the data to build the unit's take-home package. Its CMTC creators designed computer screens in an object-oriented format which

permitted easy movement through a hierarchy of computer screens, beginning at the mission or task-list level, then to an intermediate-level screen as necessary and finally to a task screen. In addition to the three major mission task lists adopted from the ECS, the MTP training and evaluation outline task list and CMTC's own peacekeeping task list were included to cover the gamut of possible mission scenarios. Finally, other data fields were generated to collect unit data, and software buttons were designed to provide access to other functions and to permit future add-ons.

CMTC rotation schedule. The importance of adding the MTP and task lists for military operations other than war (MOOTW) becomes apparent once the training battalion's rotation schedule is understood. A typical battalion/task force rotation at CMTC lasts approximately three weeks and consists of four phases. The first is three days long and focuses on unit deployment and staff preparation. Next, the battalion has five days devoted to platoon- and company-level situation training exercises, followed by 10 days of battalion-level METL exercises training against a live opposing force. The rotation ends with a three-day recovery and redeployment phase.

The three deployment days require the battalion leadership to fight two to three high-intensity battles in the Battalion/Brigade Simulation (BBS). During these constructive simulation battles, the battalion commander and staff plan, prepare and supervise the execution of an attack, defense or movement to contact. As commanders and staff work, O/Cs monitor the activity to provide the battalion leadership feedback after each operation.

The five days of situational training exercises (STXs) provide the battalion commander the opportunity to work on platoon- and company-level collective tasks in preparation for the 10 days of live simulation in the maneuver area. Again, O/Cs are present to assist lane facilitators in the planning, set-up and execution of training. They also provide unit leadership with observations that can be integrated into AARs after each training event. Following a maintenance and recovery period, the battalion enters the rotation's most intensive training.

The continuous 10-day exercise is fully instrumented using Multiple Integrated Laser Engagement

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Simulator II. The execution of the METL is normally divided into seven days of high-intensity conflict missions and three days of MOOTW. The seven days of high-intensity operations are normally focused on attack, defend and movement-to-contact missions, while the three days of MOOTW are devoted to occupying and operating in a zone of separation. During all phases of the deployment, O/Cs observe training and provide performance feedback on key figures and the unit as a whole.

TFS applicability to other simulations. Even though the CMTC team originally designed the TFS exclusively for the live simulation portion of a unit's rotation, it soon became apparent that the new system could also contribute significantly during the constructive BBS exercises earlier in the training cycle. Half of the TFS tasks were also relevant to the goals of the BBS-driven exercise and could be observed and recorded with the same precision as during the live simulation.⁵

Because BBS operations and data collection took place in a separate facility from that of the live missions, a different set of procedures had been traditionally employed to collect and provide feedback to units. By employing the new TFS, trainers could standardize collection of performance data and preparation of the mission summary for constructive simulations as well as live simulations. The fledgling TFS was becoming the standard toolkit for fulfilling the O/C's feedback requirements. But its usefulness did not end here.

Application—STX. The collective tasks are trained during the course of an STX, often referred

to as lane training. With limited terrain for training, commanders usually allocate "lanes" to train three to four units simultaneously, each on a different set of collective tasks. After meeting the standards for the training published in the MTP, units rotate to another lane. Since the center's O/Cs facilitate the lane training and have a digitized MTP in the TFS software, TFS quickly proved useful for providing doctrinally correct, standardized and digitized feedback within units.

The TFS had demonstrated its utility for training conducted, observed and controlled by the unit, as well as for unit training observed and controlled by the training center. TFS was no longer an institutional, training center program but a tool that units could use themselves. The TFS program works on a unit's computer in a local training area as well as at CMTC. But would commanders agree, or would they dismiss the TFS as yet another automation gimmick and stow it in their wall lockers?

Home-station staff training. Most battalion commanders saw the usefulness of TFS as a performance-data collection-and-feedback tool at the CMTC; moreover, a few saw its utility beyond a training center environment. These commanders believed they could use TFS as a staff-training tool. Because the battalion/task force version showed the elements, standards and natural flow of staff tasks during phases of each mission, TFS would prove a worthwhile program for teaching the fundamentals of each position and linkages among them.

One commander further suggested that if feedback mission summary reports could be modified, operations orders could be generated in their place. While this suggestion had considerable merit and was theoretically possible, the reprogramming effort proved insurmountable for the team's limited resources. Another commander suggested that the program could be improved by the addition of battalion/task force standing operating procedures (SOP). This was accomplished, and the TFS toolbar soon included the SOP to supplement the field manual and the MTP. The newly included SOP was useful to those using battalion computers. But more important for the O/C or unit trainer, the easily accessed SOP permitted a speedy comparison between how the battalion/task force said it did business and what it demonstrated. At least one battalion commander found such feedback extremely useful in assessing unit shortcomings.

Further dialogue and various modifications made TFS more useful for both O/Cs and commanders. To make TFS useful in local training areas, some commanders suggested adding a platoon application and greater capability to customize or select only specific tasks for a training event. As a result, the

customization feature was added, and team members created a tank platoon version of the standard TFS. The battalion commander now had an automated tool that could accommodate customized task lists and facilitate training from the platoon level on up. The customization feature was also added to the battalion/task force and company/team versions, increasing their usefulness.

The Armor School—an institutional setting. Observing multiple rotations of similar units training similar missions against a similar opposing force reveals trends in unit deficiencies and reasons some units perform better than others do. Deficiencies were most acute at the platoon level. CMTC trainers noted, for example, that a common platoon leader deficiency is land navigation and the associated skill of map reading. Most platoon leaders also lack an inherent understanding of the military decision-making process, frequently demonstrated in an inability to plan, prepare and execute basic missions according to doctrine. TFS could do little to instill land navigation skills, but the system could be adapted to fix the latter problem.

After the addition to TFS of a platoon version for tank and mechanized infantry platoon leaders, the utility seemed to expand not only to operational units but also to training institutions. Such a training tool would surely meet many of the demands of future Army training.⁶ The TFS version designed for institutional use could be used by officer basic course students to help learn and manage operations-specific tasks and for the instructors to provide student feedback. With some modification to the original TFS, the TFS structure could help young officers understand the Army's decision-making paradigm. Because TFS tasks flow in a natural sequence and because there is a linkage between tasks, the process can be mapped. The map could then be used as a model to help understand the decision-making process. And, what better place to provide such a tool than the US Army Armor Center's Officer Basic Course?

The US Army Armor School saw potential for reinforcing the decision-making process and for providing an administration tool so that small-group instructors could monitor and record performance associated with the tasks. Once accustomed to both the decision process and the functionality of the TFS, graduating officers could take the program to their first assignment to help further train themselves and their units. The program would be a valuable addition to their training toolkit and standardize training management tools once the program became an integral part of SATS.

SATS complements TFS. SATS functions were designed to alleviate much of the routine and

manpower-intensive work associated with the training cycle described in US Army Field Manual 25-100, *Training the Force*.⁷ It has a series of utilities that help manage training resources such as training aids, ammunition and scheduling. While SATS

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accomplishes these goals, it does not facilitate managing the execution and assessment of training.

Since the TFS provides an effective platform for assessment, when added to the SATS, it will help link training execution and assessment to planning and available resources, thus completing the training cycle. Discussions with the SATS program manager have indicated that TFS would be integrated as a module into SATS, while retaining its ability to also operate as a stand-alone program.

However, even with various upgrades to the TFS, not even the institutional version had much of a chance. One very large reason for this is that TFS is a hard-coded program. Its database architecture makes it very difficult to incorporate any changes. Unless one is willing to reprogram the TFS, with its associated costs, the program will not accommodate new references, new task lists or changes in administration. Another problem: TFS is a stand-alone program. While networking the program is a feasible way to overcome this problem, the issue of interoperability is merely transferred from the single program to the specific network. Ultimately, decision makers were unwilling to make the investment to reconfigure TFS for either the operational or institutional environments.

The future of TFS. The TFS has undergone several modifications over the past five years. With funding from Department of the Army, the Combined Arms Center and 7th Army Training Command, TFS was modified and recompiled several times. It was used for two years at the CMTC and later introduced at the NTC, but it never progressed beyond the task-force O/C team level. Because the mission-based task lists were only developed for the maneuver battalion, company/team and platoons, the brigade, aviation, field artillery and forward support teams could never take advantage of the capabilities that TFS provided the other echelons.

The "University After Next" concept may include an educational structure that will support the future Army in two ways: by developing leaders capable of meeting the demands of a more versatile Army and by providing a collaborative environment of online knowledge available through libraries, simulations and a virtual staff and faculty.

The recent adoption of the battle functions by the US Army Training and Doctrine Command—integrated task lists that are both horizontally and vertically linked—offers an alternative task-list paradigm to the currently available versions for TFS. This updated, more flexible and more robust method of tracking task accomplishment promises considerable improvement in the performance-data collection-and-feedback process, especially at the brigade level. TFS is still too cumbersome and inflexible to meet the demands of the future Army.

Situation Reviewed

The Army still needs an education and training tool that can assist teacher/trainer and student/trainee alike to prepare for the increasingly complex operating environment. The Army continues to look for answers within, while much research and discussion is already available from a broader public education sector. According to author P.M. Privateer, "to be truly a revolutionary force in education, academic technologies should be deployed in new kinds of academic environments driven by a real understanding of change; reflect an understanding of the underlying catalysts for this change; and be driven by an understanding of how new digital technologies require radically new and different notions of pedagogy."⁸ The US Army Center for Army Lessons Learned (CALL), Fort Leavenworth, Kansas, has both an astute appreciation for the changes required in the Army's education system and an understanding for the catalysts for this change.

The "University After Next" concept may include an educational structure that will support the future Army by developing leaders capable of meeting the demands of a more versatile Army and by providing a collaborative environment of online knowledge available through libraries, simulations and a virtual staff and faculty. This concept describes a knowledge and advanced learning environment (KALE).⁹ Such a format requires challenging the basic system of teaching and learning "rather than simply incorporating learning technologies into current instructional approaches."¹⁰ Privateer provides a guiding question for applying technology to new notions of pedagogy: "how can computer- and telecommunication-mediated instruction assist colleges

and universities in reinventing themselves as 'virtual' and 'real' places in which students can transcend outmoded ways of gathering information to become new kinds of learners, driven by the desire to use their intelligence to solve problems?"¹¹

Combining Privateer's guidance with the Army's notion for a future educational enterprise—the University After Next (UAN)—the Army must address the following critical issues to be successful:

- How do we train leaders?
- How do we provide leaders with an instantly accessible university environment that combines a virtual research library, connectivity to faculty and subject matter experts (SMEs) and subscription to a wide array of usable training products ranging from courseware to tailored simulations?
- How do we provide leaders with a linked information system that allows them to exploit UAN assets in self-development, unit training and operations?

Leader-learners of tomorrow will have to adjust to a very different educational structure than the one currently employed. They will be inundated with information unprecedented in today's academic environment. Author Roger Heimstra believes that in many respects, "future learners will need to become self-directed throughout their lives just to cope with the huge quantity of information available to them."¹² Learners of the future will also have a host of new learning devices available to them. Author C. Dede suggests that while these new media can dramatically improve instructional outcomes, all will depend on the careful design of the interface among the devices, learners and teachers. Learners will need to build knowledge proactively.¹³ Heimstra believes more research is needed to determine better ways of incorporating computer technology and electronic communication into self-directed learning as more distance education programs are created.¹⁴ This requirement is especially applicable to the Army's future learning system. So, what kind of tool does the Army's future leader-learner need?

Knowledge and Advanced Learning Tool

Taking the best of TFS past and combining it with the instructional technologies of today and tomorrow suggests a simple tool to provide information. Such a tool should be meaningful for a novice in the institution, self-directed learners, unit trainers and soldiers in operational settings

For the Army to create its UAN, it will have to take advantage of the same technologies that current on line universities have. Computer-mediated conferencing systems and the Internet's enabling of asynchronous and synchronous interaction among students and instructors will play an instrumental part in KALE's success. "With the development of the World Wide Web as an additional powerful learning tool," Hanna states, "there exists the poten-

tial for radically altering the learning environment in all settings by enabling and supporting interactive, socially constructed learning, and by dramatically increasing the educational resources, materials and documents available to learners at the click of a mouse.^{7,15}

While KALE describes the environment, the Knowledge and Advanced Learning Tool (KALT) will serve as the interface between student and university. One way to envision KALT is as programmable and formatable software which would access required content, link it to any known knowledge source and personalize screen layout.

Perhaps the best way to envision the concept is to experience some of its salient features. KALE's homepage offers a demonstration of how KALT will function from the perspective of a new Armor platoon leader. The demonstration will also go through the tutorial, interactive and trainer/instructor versions of the program.

The *tutorial mode* is designed for use by students in the schoolhouse environment but can also be used by any soldier new to a particular branch, echelon or assignment. Its primary purpose is to expose students to the nuances of their branches and to get them thinking and responding in a manner conducive to successful military operations. For this particular demonstration students will be exposed to one select mission specific task, an on line reference and one example of possible tactics, techniques and procedures (TTP) the tank platoon leader must know to fight his platoon from a defensive position.

The *interactive mode* is designed for advanced students, leaders, trainers and others engaged in self-development. Perhaps the most complex mode, it will allow access to any information required in either a learning or operational environment. While predominantly a learning tool to be used in conjunction with computers, at some point it will become

an integral part of the command, control and communications architecture used by future units and training centers. For this demo the interactive mode will interact with selected tasks and TTP associated with offensive operations. The focus will be on movement and actions prior to and immediately upon contact.

Finally, the *trainer/instructor mode* is designed for leaders and trainers in units and training centers and for instructors in the schoolhouse. The trainer/instructor mode includes many administrative features not available with the tutorial and interactive modes, such as archiving and retrieval. This version would be used by the tank platoon leader's instructor or company commander to assess readiness of the leader or platoon but could be used by the platoon leader. In any of these three venues, the learning focus is on the platoon in an operational setting, hence its name: operations management and performance feedback.

While the demonstration of KALT offers a glimpse of how soldiers might interact with their future education and training environment, it is limited by Hypertext Markup Language (HTML) technology. The web of HTML documents is good for what it is, simple display markup with links. But many different, non-HTML user interfaces, such as spreadsheets and presentation programs, are well understood but not particularly relevant to HTML. Another format, Extensible Markup Language (XML) is a fresh start, taking the best ideas of the web (such as open-file formats) and bringing it to a broader range of software.¹⁶ It is this format that will drive the Army's KALE, an environment that can only be explored and exploited with the appropriate tool. KALT with its search engine(s) and control interfaces is just that tool. From TFS to KALT we have come a long way, but with so many capabilities just beyond the horizon, we still have a long way to go. **MR**

NOTES

1. Karl J. Gunzelman, *A Training Task Paradigm to meet the Operational and Training Needs of the Future Army* (Carlisle, PA: US Army War College), 28.
2. Army Research Institute, *The Training Information Management System, Volume 1, Technical and Management Overview* (Woodland Hills, CA: Perceptions Incorporated), 17.
3. US Army Field Manual 71-2, *The Tank and Mechanized Infantry Battalion Task Force* (Washington, D.C.: US Government Printing Office, 1988).
4. US Army Field Manual 71-123, *Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion Task Force and Company Team* (Washington, D.C.: US Government Printing Office, 1992).
5. There are a total of 105 tasks listed for the movement to contact mission. The O/C team found that of the total tasks, 62 could be observed and recorded during the BBS constructive simulation.
6. Karl J. Gunzelman, *A Training Task Paradigm to meet the Operational and Training Needs of the Future Army*.
7. US Army Field Manual 25-100, *Training the Force* (Washington, D.C.: US Government Printing Office, 15 November 1988).
8. P.M. Privateer, "Academic technology and the future of higher education:

- Strategic paths taken and not taken," *The Journal of Higher Education* 70(1), 60-79.
9. LTG Montgomery C. Meigs and Edward J. Fitzgerald III, "University After Next," *Military Review* (March-April 1998).
10. Donald E. Hanna and Associates, *Higher Education in an Era of Digital Competition: Choices and Challenges* (Madison, WI: Atwood Publishing, February 2000), 55.
11. P.M. Privateer, "Academic technology and the future of higher education: Strategic paths taken and not taken."
12. Roger Heimstra, "Self-Directed Learning" in *International Encyclopedia of Adult Education and Training* (Oxford, UK: Pergamon Press, 1996), 431.
13. C. Dede, "The Evolution of Learning Devices: Smart Objects, Information Infrastructures and Shared Synthetic Environment" in *The Future Networking Technologies for Learning* (Washington, D.C.: US Department of Education), 9.
14. Roger Heimstra, "Self-Directed Learning."
15. Donald E. Hanna and Associates, *Higher Education in an Era of Digital Competition: Choices and Challenges*.
16. Tim, John and Bray Bosack, "XML and the Second Generation Web," *Scientific American*, May 1999.

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